# EE 200: Problem Set 1

1. Prove de Moivre's formula: $(\cos\theta + j\sin\theta)^n = \cos(n\theta) + j\sin(n\theta)$.

   Using the above formula, find the rectangular form and polar form representations of the following complex numbers:

   (a) $\eta_1 = (1 + j\sqrt{3})^{10}$ (b) $\eta_2 = (\sqrt{2} - j\sqrt{2})^{1/5}$

2. Show that: $\dfrac{1}{1 - e^{-j\omega}} = \frac{1}{2}(1 - j\cot^{(\omega/2)})$

3. Prove that $\sum_{n=0}^{\infty} \alpha^n = \dfrac{1}{1-\alpha}$, $|\alpha| < 1$, where $\alpha$ is a complex number. Thus, the geometric series is convergent. Show that for $|\alpha| \geq 1$, the above series is divergent.

4. Prove that

$$\sum_{n=0}^{N-1} \alpha^n = \begin{cases} \frac{1-\alpha^N}{1-\alpha} & ; \quad \alpha \neq 1 \\ N & ; \quad \alpha = 1 \end{cases} \tag{1}$$

5. Write a MATLAB function *polar2rect* to convert a complex number represented in polar form to its rectangular form. Using this function find the rectangular form of $\eta = 4e^{\frac{j2\pi}{3}}$.

6. Write a MATLAB function *rect2polar* to convert a complex number represented in rectangular form to its polar form. Using this function find the polar form of $\eta = 2.2 - j6.6$.

7. Write a MATLAB script *gcd2* to determine the GCD of three integers. The input data is the set of integers and the output data is their GCD. Using this code find the GCD of the set of integers $\{12, 32, 96\}$.